DOCUMENT RESUME

ED 166 032 SE 026 355

AUTHOR Elvin, Betty; And Others
TITLE Texas Energy Education Framework: A Pilot Draft.
INSTITUTION Texas Education Agency, Austin.
PUB DATE 78
NOTE 28p.; Contains occasional light and broken type

EDRS PRICE MF-$0.83 HC-$2.06 Plus Postage.
DESCRIPTORS Conceptual Schemes; *Curriculum Development; *Curriculum Guides; *Elementary Secondary Education; Energy; *Energy Conservation; Environmental Education; *Matrices; Units of Study
IDENTIFIERS *Texas

ABSTRACT

This publication presents a conceptual framework for grades K through 12 energy education in Texas. Matrices are used in which "basic concerns of people" such as: (1) individual well-being; (2) career; and (3) social interactions are given on one axis and three learning dimensions: (1) knowledge; (2) applications; and (3) values are used on the other axis. These matrices are to serve as a guide to curriculum development and are given for grade levels K-3, 4-6, 6-8, and 9-12. Energy education experiences are given for parts of these matrices. Infusing energy education into existing curricula is expanded and a rationale for energy education is given. (MR)

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TEXAS ENERGY EDUCATION FRAMEWORK

A PILOT DRAFT

Texas Education Agency

Austin, Texas
1978

SE 026 355

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FOREWORD

The Texas Energy Education Framework is designed to assist teachers, administrators, and other school personnel in the process of infusing energy conservation concepts into the public school curriculum. The Framework focuses on the basic concerns and needs of people and suggests ways in which energy conservation can become a meaningful part of all disciplines in elementary and secondary schools.

We hope that the Framework will be a useful tool in helping young people become more aware of the critical decisions which we all face in meeting the present and future energy needs of our state and nation. The future of our society depends in large measure on the thoughtfulness and wisdom of these decisions.

M. L. Brockette
Commissioner of Education

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Division of Curriculum Development

IRA NELL TURMAN, Project Coordinator
for Energy Education

ACKNOWLEDGEMENT

ENERGY EDUCATION FRAMEWORK WRITING COMMITTEE

Betty Elvin
Science Teacher
Coldspring-Oakhurst Independent School District

Bill Holifield
Assistant Superintendent of Instruction
Plano Independent School District

Connie McQueen
Elementary Teacher
Temple Independent School District

Mike Owens
Consultant, Instruction
Region VII Education Service Center, Kilgore

Robert Reeves
Division Director, Special Services
Region I Education Service Center, Edinburg

Gail Riley
Social Studies Teacher
Hurst-Euless-Bedord Independent School District

Joseph Strehle
Director, Development and Resources
Region IV Education Service Center, Houston

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TEXAS ENERGY EDUCATION FRAMEWORK

RATIONALE

The State of Texas has assumed a position of national leadership in agricultural and industrial development. Its bounty of natural resources and variety of terrain and climate have attracted people from throughout the world. Texas' population has more than doubled in the last decade. Texas citizens, like those across the nation, are also enjoying the benefits of rapid technological development; life is becoming more comfortable, safe, and rewarding. These are very positive developments in which the people of Texas can take justifiable pride. Hard work and creative thinking have, indeed, produced the "good life" in our state. Unfortunately, these same factors of rapid population growth and technological developments have resulted in greater and greater demands on our state and national supply of energy. We are consuming energy much faster than the supply can be replenished. The shortage is becoming more critical and the future does not look bright. The very survival of human beings and society depends on current and future decisions we made regarding our use of energy. Energy conservation has become a most critical national, state, community, and personal priority.

Few people would take issue with the fact that conservation of energy is essential. What is planned, developed, and accomplished in the area of energy conservation will be the collective result of the individual efforts of Texas people. One person cannot even address a problem of this magnitude, let alone work out a solution. Each person can only react to the problem as it affects his or her own personal life. There are certain basic concerns of people which relate directly to the quality of life they can expect to have. When people realize that the future availability of energy will directly affect their personal health, ability to work, and ability to enjoy the fruits of their labor, they begin to take action.

This framework for energy education in Texas schools is designed to address the problem of energy consumption from the standpoint of each individual and to suggest the effect which wise use of energy can have on the quality of life. The basic concerns of all people include personal health and well-being, career choice and development, consumer activity, enjoyment of leisure time, and a satisfying role in society. This framework will demonstrate how each person's use of energy will directly affect these basic concerns. For example, a diminished supply of energy directly impacts the consumer. The price of gasoline continues to rise, thereby causing each person to spend a greater proportion of personal income on fuel. It also causes local shortages which restrict travel, spoil vacation plans, and even affect employment and home location. There are steps which each person can take to moderate the use of gasoline and therefore to avoid family budget problems and inconvenience which a critical shortage would produce. This framework systematically addresses individual problems and focuses on the question: "How can energy conservation affect me?"

An effort has been made to relate the basic concerns of people to experiences which they would have as elementary school students, middle school students, and young adults in the high school. People of all ages have concerns related to personal health and well-being, career choice or development, recreation, money supply, and social interaction. The framework directs attention to these concerns and to how they relate to individual use of energy. The concepts, applications, and values are outlined in a K-Grade 12 continuum which is designed for infusion into the regular curriculum offerings of the school.

GENERAL GOALS

The student will:

... Help to make conservation of energy a national, state, community, and personal priority

... Become aware of one's role as a consumer and conserver of energy.

... Be familiar with the various types of energy and how they can be changed from one form to another

... Be familiar with the major career opportunities in the energy field

... Understand the legal/social implications in the production and use of various types of energy

... Understand the environmental and economic impact of the use of energy and the effect which this may have on each person's life style

... Understand the effect of energy production on the Texas economy

DESCRIPTION OF THE ENERGY EDUCATION MATRIX

The following Energy Education Matrix serves as a basis for formulation of the Texas Energy Education Framework. It is designed to ensure the development of learning activities directly related to the personal concerns of people. The basic concerns of people listed on the horizontal axis are:

. . . Consumer Behavior
. . . Personal Health and Well-being
. . . Career Choice and Development
. . . Leisure Time and Recreational Activity
. . . Social-Legal Interaction of People

It is assumed that students will need learning experiences in three basic dimensions which relate energy conservation to these personal concerns. These dimensions listed on the vertical axis of the Matrix are:

. . . Knowledge (Concepts)
. . . Applications of Knowledge (Activities)
. . . Values and Attitudes

The interaction of the basic concerns of people (horizontal axis) and the dimensions of learning (vertical axis) create 15 instructional development cells. For example, in Cell One, the interaction of personal consumer concern and content knowledge creates a base for design of learning content related to consumer behavior. Such topics as the relationship between energy supply and price, wise shopping for energy-efficient appliances, the effect of energy shortage on the quality of goods and services, the relationship to personal comfort, the cost effectiveness concept, and selection of clothing for different seasons could be developed using this cell as a planning base.

Cell Eight, created by the interaction of educational applications as related to career concerns of people, creates a planning base for student understanding of how changes in energy supply will affect job opportunities in future years. For example, the student will be able to see how new sources of energy such as wind, solar, and geothermal, will offer new career opportunities. Such concepts as the effect of energy shortage on the recreational industry, on new energy forms related to engineering job opportunities, and on applications of solar energy (including opportunities for development of extra-terrestrial collectors) would be included. The career opportunities exploration and selection process will undergo tremendous change in application during the coming years. All phases of curriculum should reflect not only changes in job opportunities, but the need for early exploration, planning, and proper training for the world of work in the future. This cell, like all others, is only intended as a springboard in the area of curriculum planning and by no means presents all of the possible applications.

The Energy Education Matrix

The following charts present an array of examples delineating the kinds of learning experiences that could be designed using each of the 15 cells as a planning base. The curriculum designer or teacher can, from this kind of base, delineate a multitude of learning activities for each cell as they relate to science and social studies as well as to all other disciplines. The basic concepts and educational programs which follow are all based on the use of this Energy Education Matrix as a planning base. Items included like the descriptors in the Matrix are by no means all inclusive, but only represent examples of the kinds of learning experiences that can be infused into all phases of the elementary and secondary school curriculum.

ENERGY EDUCATION MATRIX

	Consumer	Individual Well-being	Career	Recreational	Socio-Legal
Knowledge	(1) Knowledge of energy conservation affects consumer behavior.	(2) Individual health and well-being is directly affected by energy conservation.	(3) Changing patterns of energy use affect career opportunities now and in the future.	(4) Energy shortages and changing patterns of use affect the recreational activities of all people.	(5) Changing patterns of energy consumption and energy regulations affect individual lifestyle and the world society.
Application	(6) Applications of consumer knowledge relate to energy conservation.	(7) Application of energy conservation techniques improves individual health and well-being.	(8) Educational requirements for new jobs resulting from energy conservation are changing rapidly.	(9) Applications of information regarding wise use of energy will make the use of leisure time more enjoyable and personally satisfying.	(10) Application of social-legal knowledge related to energy conservation affects the ability of each individual to live in harmony with other people of the world.
Values	(11) Consumer values affect the total use of energy.	(12) Personal values related to energy use affect the health and well-being of each individual.	(13) Career values and work ethics relate to the changing energy picture and job satisfaction.	(14) Personal values regarding the use of energy for recreation affect the total consumption of energy.	(15) Social and political values are directly related to availability of energy and influence its transportation and consumption.

INTRODUCTION TO MATRICES K-3, 4-6, 6-8, 9-12

The need for energy education is critical and should be infused at all instructional levels and in all subjects. Toward this end, matrices of instructional cells for energy education have been developed for Kindergarten through Grade 3, for Grades 4 to 6, for Grades 6 to 8, and for Grades 9 to 12. Although school communities have their own expectations and their own needs, the matrices seek to show common concerns in energy education. The Framework for Energy Education aims at infusing the concept of energy conservation in the Kindergarten through Grade 12 curricula while enlisting all students and educators in the energy management team.

The matrices on pages 8, 10, 13, and 15 are examples of how the goals for energy education can be expanded to include objectives for classroom activities. The matrices are not comprehensive lists of the knowledge, applications, or values applicable to energy education. The teacher is expected to use the matrices as guides in developing his or her instructional program for energy education.

The Energy Education Experiences on pages 9, 11-12, 14, and 16 illustrate how individual instructional cells of the matrices are applicable to a number of subjects. Teachers are urged to reflect on their instructional sequences and focus appropriate segments on energy education goals.

GRADES K-3 MATRIX

OBJECTIVES FOR ENERGY EDUCATION

	Consumer	Individual Well-Being	Career	Recreational	Socio-Legal
Knowledge	The student will become aware that energy can be changed from one form to another.	The student will be aware of interdependence of energy use and personal comfort.	The student will be cognizant of energy uses in parents' jobs.	The student will be aware that the games we play use energy.	The student will become aware that our homes benefit from energy-efficient decisions.
Application	The student will dramatize energy changes by rubbing hands together, turning on light switch, etc.	The student will locate pictures of clothing for each weather situation.	The student will be aware that the nature of jobs changes with the source of energy used.	The student will compare the relationship between physical motion and body heat.	The student will be aware of classroom rules that regulate classroom uses of energy.
Values	The student will tell five ways energy is wasted.	The student will choose pictures from a picture file showing conditions which might affect heating and cooling devices.	The student will determine which jobs use the least amount of energy and how the community is affected.	The student will realize that there can be personal satisfaction in independent play without expending excessive energy.	The student will tolerate some degree of discomfort or loss of independence for the benefit of all.

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GRADES K-3 ENERGY EDUCATION EXPERIENCES

CAREER APPLICATION

THE STUDENT WILL BE AWARE THAT THE NATURE OF JOBS CHANGES WITH THE SOURCE OF ENERGY USED. The following activities illustrate how one instructional cell of the matrix is applicable to several subjects. This is not an exhaustive list of possible appropriate activites. The teacher should adapt these or other instructional activities to meet the particular needs of his or her students.

SUBJECT	CORRELATING ACTIVITIES
Language Arts and Social Studies	Students make a list of workers involved in insulating a house and indicate the differences in their jobs depending on the energy saving device used.
Science	Students interview workers who use alternative sources of energy in construction and ask how they increase home energy efficiency by using these different sources of energy.
Mathematics	Students compute the number of days different workers spend in building houses using energy-saving methods.
Art	Students make a mural showing the workers at various stages of building a house.
Music	Students make musical instruments from discarded building materials to develop an awareness of different sources of energy conservation.
Health	Students develop a simple dance in which they imitate the workers.
Reading	Students read stories related to construction with regard to the variety of jobs of workers.

GRADES 4-6 MATRIX

OBJECTIVES FOR ENERGY EDUCATION

	Consumer	Individual Well-Being	Career	Recreational	Socio-Legal
Knowledge	The student will be aware that consumer decisions are usually directed by one's particular environment or culture.	The student will be aware that the suffient supply of energy depends essentially on lifestyles and the wise use of natural resources.	The student will be aware that the field of energy offers major career opportunities and satisfying work experiences.	The student will be aware that the supply of world energy affects the way we use leisure time.	The student will be aware that the supply and use of energy is directly related to the world's economic and political well-being.
Application	The student will identify the useability span of four types of beverage containers.	The student will be aware of wasteful uses of energy at home and at school and will be able to determine measures which increase the sufficient supply of energy.	The student will identify energy related jobs in society today.	The student will list favorite recreational activities and determine the type of energy used.	The students will maintain files of newspaper clippings and magazine articles related to the supply and use of energy to determine the impact on their community, state, and nation and on the world.
Values	The student will discuss cultural differences in energy use patterns.	The student will discuss how the use of energy affects individual well-being and the fate of generations to come.	The student will discuss the types of tasks performed in jobs in the energy field.	The student will discuss how decisions, lifestyles, and leisure time affect energy efficiency.	Students will compare energy uses in their homes and community.

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GRADES 4-6 ENERGY EDUCATION EXPERIENCES

INDIVIDUAL WELL-BEING AND KNOWLEDGE

THE STUDENT WILL BE AWARE THAT THE SUFFICIENT SUPPLY OF ENERGY IN THE UNITED STATES DEPENDS ESSENTIALLY ON LIFESTYLES AND THE WISE USE OF NATURAL RESOURCES. The following activities illustrate how one instructional cell of the Energy Concerns Matrix is applicable to several subjects. This is not an exhaustive list of possible appropriate activities. The teacher should adapt these or other instructional experiences to meet the particular needs of his or her students.

SUBJECT	CORRELATING ACTIVITIES
Language Arts	The class will compile a newspaper about energy and its conservation. Include headlines, news stories, feature stories, editorials, letters to the editor, cartoons, and advertisements on how energy could be conserved. The writing of the editorials could be used as a class contest or expanded into a school-wide contest.
Spelling	Introduce the spelling of energy related words. Students participate in class or school "spelling bees."
Reading	Students write a simple poem about the wise use of energy and read aloud to the reading group.
Mathematics	Students prepare a chart of temperatures in the classroom/school. Chart shows the monthly fuel cost.
Science	Students keep records of their use of electricity for one day, noting the purpose of each energy use and the ways energy could be conserved.
Social Studies	Students list items commonly used in the home which are considered luxury items, convenience items, and necessity items and do a comparative study of costs in terms of energy usage

Grades 4-6

SUBJECT	CORRELATING ACTIVITIES
Art	Students design logos and slogans that will inform people about the need to conserve energy. Students paint a mural using these logos and slogans. After securing permission from local merchants, students reproduce the mural on a store window to further public awareness of need for energy conservation.
Music	Students make a class collection of songs related to energy and learn to sing the songs. Using some of the songs they have learned, students write and produce a play to be presented for the student body.
Health	Students compare health problems of the United States to those of countries that consume less energy than the United States.

GRADES 6-8 MATRIX

OBJECTIVES FOR ENERGY EDUCATION

	Consumer	Individual Well-Being	Career	Recreational	Socio-Legal
Knowledge	The student will be aware that energy is transformed with a loss of energy during each transformation.	The student will be aware of interdependence of energy use and personal comfort.	The student will be aware of various career opportunities involved in the transformation of energy from source to useable product.	The student will be aware of interdependency of energy use and personal comfort. →	The student will be aware that transformation of energy from source to useable product presents environmental and economic problems.
Application	The student will investigate the form of energy used to produce each of the four basic food groups.	The student will measure temperatures over plants, fabrics, earth materials, and other surfaces.	The student will create a slide story of careers associated with energy transformation.	The student will list favorite recreation activities and energy requirements of each.	The student will identify two uses of land and will compare job opportunities and economic importance of each use.
Values	The student will compare nutrition and energy economics of each food group.	The student will discuss advantages and disadvantages of adjusting lifestyles to maximum energy efficiency.	The student will select a career and defend it in terms of energy efficient decisions.	The student will discuss and compare personal satisfaction associated with favorite recreational activities in terms of energy cost.	The student will participate in a simulation activity and will discuss advantages and disadvantages of land uses.

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GRADES 6-8 ENERGY EDUCATION EXPERIENCE

SOCIO-LEGAL AND KNOWLEDGE

THE STUDENT IS AWARE THAT TRANSFORMATION OF ENERGY FROM SOURCE TO USABLE PRODUCT PRESENTS ENVIRONMENTAL AND ECONOMIC PROBLEMS. The following activities illustrate how one instructional cell of the Energy Concerns Matrix is applicable to several subjects. This is not an exhaustive list of possible appropriate activities. The teacher should adapt these or other instructional experiences to meet the particular needs of his or her students.

SUBJECT	CORRELATING ACTIVITIES
Language Arts	Students interview senior citizens and compare to the present the lifestyles and economic and environmental problems of earlier days when energy use wasnot limited.
Social Studies	Students investigate the environmental and economic impact on the community of the use of various types of energy.
Science	Students design an experiment to change energy from one form to another.
Health	Students compare types of current health problems of the community with health problems of earlier days when energy use was a fraction of present use.
Mathematics	Students plot the economic value of energy produced and the cost of dealing with the environmental problems incurred.
Art	Students make a diorama of events in earth history that have caused resources to be concentrated in certain locations.
Music	Students experiment with amounts of electrical energy required to produce sounds in various instruments and in amplifier systems.

GRADES 9-12 MATRIX

OBJECTIVES FOR ENERGY EDUCATION

	Consumer	Individual Well-Being	Career	Recreational	Socio-Legal
Knowledge	The student will understand that energy conservation will affect his or her behavior as a consumer.	The student will be aware of the interdependence of personal well-being and comfort and energy consumption.	The student will understand that changing patterns of energy use and alternative sources of energy affect career opportunities now and in the future.	The student will be aware of how the availability of energy and efforts to conserve will affect recreation and lifestyle.	The student will understand that improved energy conservation practices will cause major changes in individual lifestyle and world society.
Application	The student will describe an energy-efficient home, car, school and appliance.	The student will provide at least two examples each of how group and individual well-being are improved by energy conservation in areas of transportation, housing, and recreation.	The student will identify at least five major changes which energy conservation practices or which alternative sources of energy will have on job opportunities in each of the 15 major occupational clusters.	The student will list and compare energy efficient vs. inefficient recreational activities in the areas of travel, sports, hobbies, and home care.	The student will list at least two major changes in law or social customs which have taken place in the areas of transportation, housing, and recreation as a result of energy shortage.
Values	The student will list the specific advantages and disadvantages of acquiring an energy-efficient home, automobile, or appliance.	The student will prepare a balance sheet to compare the effect of energy efficient vs. inefficient transportation, housing, and recreation on personal comfort and well-being.	The student will list the changes which have occurred in his or her parents' careers as a result of changing energy availability.	The student will identify changes which have occurred and project future changes in his or her recreation lifestyle as a result of energy conservation.	The student will prepare a balance sheet to compare the present and projected laws and customs in the areas of transportation and housing as a result of energy conservation practices.

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GRADES 9-12 ENERGY EDUCATION EXPERIENCE

INDIVIDUAL WELL-BEING AND APPLICATION

THE STUDENT WILL PROVIDE AT LEAST TWO EXAMPLES EACH OF HOW GROUP AND INDIVIDUAL WELL-BEING ARE IMPROVED BY ENERGY CONSERVATION IN AREAS OF TRANSPORTATION, HOUSING, AND RECREATION. The following activities illustrate how one instructional cell of the Energy Concerns Matrix is applicable to several subjects. This is not an exhaustive list of possible appropriate activities. The teacher should adapt these or other instructional experiences to meet the particular needs of his or her students.

SUBJECT	CORRELATING ACTIVITIES
Language Arts and Language Learning	Students debate voluntary changes vs governmental control as a necessity to make changes in energy consumption.
Social Studies	Students interview people who rode trains 30 years ago and people who ride trains today and compare their experiences.
Science	Students place glass microscope slides covered with petroleum jelly in the exhaust of three different vehicles and compare the amounts of particulate matter expelled.
Health	Students predict the air pollution effect if no students drove cars to or from school.
Mathematics	Students design a scale to rate well-being of individuals riding in a vehicle and graph comparisons of different size cars.
Art	Students express one person's feelings about the need for energy conservation in areas of transportation, housing, and recreation.
Music	Students develop a rhythmic choral reading to compare the sounds of different kinds of transportation.